## CLAIMS

What is claimed is:

P059 claims

1. An apparatus, comprising:

a multi-tone receiver to detect data in a multiple tone signal, the receiver having a detector module to measure a noise power level present in the system, and the detector module to detect for an asymmetric Gaussian noise source in the background noise, and

a gain module to determine a total noise power level for a tone in the multi-tone signal based upon an equivalent noise power algorithm, the gain module to use the equivalent noise power algorithm to compensate the measured noise power level when the detector module indicates that the asymmetric Gaussian noise source exists in the background noise.

2. The apparatus of claim 1. wherein the detector module generates a scatter plot of noise error over time and the detector analyses a shape of the distribution of the noise error in the scatter plot.

3. The apparatus of claim 2, wherein the equivalent noise power algorithm alters the measured noise power level to model a noise power level of a symmetric noise source with a radius equal to a major axis of the shape of the distribution of an asymmetric Gaussian noise error in the scatter plot.

4. A method, comprising:

measuring a power level of noise for a first tone in a multiple tone signal; and

determining a Gaussian noise power level in the first tone and if a noise source is generating an asymmetric pattern of noise.

5. The method of claim 4, further comprising:

calculating a gain factor associated with the asymmetric noise pattern; and

applying the gain factor to the measured noise power level to calculate an equivalent total noise power.

6. The method of claim 5, further comprising:

determining a signal-to-noise ratio based on a signal power of the first tone and the calculated equivalent total noise power.

7. The method of claim 4, wherein the multiple tone carrier signal is a Digital Subscriber Line signal.

8. The method of claim 4, further comprising:

applying a gain factor to an average of the measured noise power level to calculate an equivalent total noise power of an effective symmetric Gaussian

noise present in the system, if the noise source is generating the asymmetric pattern of noise.

9. The method of claim 4, wherein determining if the noise source is generating the asymmetric pattern of noise, comprises:

determining the x axis amplitude of a noise error signal of the tone;

determining the y axis amplitude of the noise error signal of the tone;

determining the value of the correlation between the x axis amplitude and the y axis amplitude components of error; and

determining the average power for the x axis amplitude, average power of the y axis, and the correlation between the x axis amplitude and the y axis amplitude over time, wherein when the average value of the x axis amplitude is significantly different than the average value of the y axis amplitude, then an asymmetric noise source is present.

10. The method of claim 9, wherein the average cross-correlation of how the x axis amplitude relates to the y axis amplitude may be calculated as

$$P_c = \frac{1}{N} \sum_{i=1}^{N} (x_i y_i)$$

where the error samples are measured over a finite time interval of $N$ samples for each sub channel, and the two main components of the $i^{th}$ measurement are labeled $x_i$ and $y_i$.

11. The method of claim 4, further comprising:

applying the gain factor to the measured power level of the noise source with an asymmetric pattern of noise to be equivalent to that of a symmetric noise source with a standard deviation equivalent to the power of the noise source with an asymmetric pattern of noise along its strongest axes.

12. The method of claim 5, further comprising:

determining bit-loading based on the signal-to-noise ratio based on the equivalent total noise power.

13. The method of claim 5, further comprising:

determining if the gain factor exceeds a first threshold amount;

activating an asymmetric Gaussian noise compensation based on the first threshold; and

deactivating the asymmetric Gaussian noise compensation based on a second threshold, wherein the first threshold is greater than the second threshold.

14. A machine-readable medium storing executable instructions to a cause a device to perform operations, comprising:

measuring a power level of noise for a first tone in a multiple tone signal; and

determining a Gaussian noise power level in the first tone and if a noise source is generating an asymmetric pattern of noise.

15. The article of manufacture of claim 14, wherein the stored instructions to cause the device to perform further operations, comprising:

calculating a gain factor associated with the asymmetric noise pattern; and

applying the gain factor to the measured noise power level to calculate an equivalent total noise power.

16. The article of manufacture of claim 15, wherein the stored instructions to cause the device to perform further operations, comprising:

determining a signal-to-noise ratio based on a signal power of the first tone and the calculated equivalent total noise power.

17. The article of manufacture of claim 14, wherein the multiple tone carrier signal is a Digital Subscriber Line signal.

18. The article of manufacture of claim 14, wherein the determining if the noise source is generating the asymmetric pattern of noise, comprises:

determining the x axis amplitude of a noise error signal of the tone;

determining the y axis amplitude of the noise error signal of the tone;

determining the value of the correlation between the x axis amplitude and the y axis amplitude components of error; and

determining the average values for the x axis amplitude, the y axis amplitude, and the correlation between the x axis amplitude and the y axis amplitude over time, wherein when the average value of the x axis amplitude is significantly different than the average value of the y axis amplitude, then an asymmetric noise source is present.

19. The article of manufacture of claim 18, wherein the average cross-correlation of how the x axis amplitude relates to the y axis amplitude may be calculated as

$$P_c = \frac{1}{N}\sum_{i=1}^{N}(x_i y_i)$$

Where the error samples are measured over a finite time interval of $N$ samples for each sub channel, and the two main components of the $i^{th}$ measurement are labeled $x_i$ and $y_i$.

20. The article of manufacture of claim 14, wherein the stored instructions to cause the device to perform further operations, comprising:

applying the gain factor to the measured power level of the noise source with an asymmetric pattern of noise to be equivalent to that of a symmetric noise source with a standard deviation equivalent to the power of the noise source with an asymmetric pattern of noise along its strongest axes.

21. The article of manufacture of claim 15, wherein the stored instructions to cause the device to perform further operations, comprising:

determining bit-loading based on the signal-to-noise ratio based on the equivalent total noise power.

22. The article of manufacture of claim 15, wherein the stored instructions to cause the device to perform further operations, comprising:

determining if the gain factor exceeds a first threshold amount;

activating an asymmetric Gaussian noise compensation based on the first threshold; and

deactivating the asymmetric Gaussian noise compensation based on a second threshold, wherein the first threshold is greater than the second threshold.

23. The article of manufacture of claim 14, wherein the stored instructions to cause the device to perform further operations, comprising:

applying a gain factor to an average of the measured noise power level to calculate an equivalent total noise power of an effective symmetric Gaussian noise present in the system, if the noise source is generating the asymmetric pattern of noise.

24. An apparatus, comprising:

means for detecting data in a multiple tone signal;

means for measure a noise power level present in the system;

means for detecting for an asymmetric Gaussian noise source in a background noise;

means for determining a total noise power level for a first tone in the multiple tone signal based upon an equivalent noise power algorithm; and

means for using the equivalent noise power algorithm to compensate the measured noise power level if the detector module indicates that the asymmetric Gaussian noise source exists in the background noise.